In the outstanding Office Action, Claim 9 was rejected under 35 U.S.C. §112, fourth paragraph. Claims 1-3 and 5-10 were rejected under 35 U.S.C. §103(a), as being unpatentable over either Chen et al. (U.S. Patent No. 6,015,290; hereinafter "Chen") or Ueyanagi (U.S. Patent No. 6,396,776) or Stovall et al. (U.S. Patent No. 6,404,706; hereinafter "Stovall") each further considered with Kobayashi et al. (U.S. Patent No. 4,840,922; hereinafter "Kobayashi") and "Peale et al.-Majors, Jr. et al.", which Applicants assume to mean Peale (U.S. Patent No. 6,314,122) and Majors, Jr. et al. (U.S. Patent No. 5,850,411; hereinafter "Majors"). Claim 4 was rejected under 35 U.S.C. §103(a) as being unpatentable over the art as applied to Claims 1-3, and further in view of Official Notice. Claim 11 was rejected under 35 U.S.C. §103(a) as being unpatentable over the art as applied to Claims 10, and further in view of Official Notice. Claims 12, 13, 15, and 16 were rejected under 35 U.S.C. §102(e) as being anticipated by Chen, Ueyanagi, or Stovall. Claim 14 was rejected under 35 U.S.C. §103(a) as being unpatentable over the art as applied to Claim 12, and further in view of Peale.

Claim 9 has been canceled by the foregoing amendment. Therefore, the rejection of Claim 9 has been rendered moot.

The present invention is directed to a thermally-assisted magnetic recording head, as illustrated in Figure 1B along with a recording medium (represented by layers 20 and 21). The head includes a laser device 10, a light absorbing film 35, and an aperture 36 (shown in detail in Figure 2A). Aperture 36 is adapted so that the polarizing direction of the laser light is approximately perpendicular to a direction (represented by arrow 70 in Figure 1B and the arrow labeled "RUNNING DIRECTION OF MEDIUM" in Figure 4A) along a longitudinal extension of recording tracks formed on recording medium 20 and 21. Further, aperture 36 includes a width W1 and a width W2 (shown in Figure 2A), where width W1 is taken along

the polarizing direction and is smaller than width W2, which is approximately perpendicular to the polarizing direction.

The above features are broadly encompassed by Applicants' Claim 1, which recites, among other features:

> ...the aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction along a longitudinal extension of recording tracks formed on the recording medium, and
>
> a width W1 of the aperture taken along the polarizing direction being smaller than a width W2 of the aperture taken approximately perpendicular to the polarizing direction.[1]

With these features, deficiencies of other systems[2] can be effectively addressed. For example, as recognized by Applicants, "the loss [of laser light] is increased as an aperture width is reduced in a direction perpendicular to the polarizing direction of the laser light while the loss is not increased as the aperture width is reduced in the same direction as the polarizing direction."[3] Based on this concept, a width along the polarizing direction of laser light (e.g., width W1) can be reduced to a dimension small enough to allow for light direction to a minute recording unit of a recording medium without significant loss of light.[4] Thus, using the thermally-assisted magnetic recording head of Claim 1, "a low noise poly-particle medium [e.g., recording medium 20 and 21, Figure 1B] of which particles have a considerably minute diameter required for high density recording/reproducing can be sufficiently durable to thermal disturbance, and in a recording magnetic field applying unit, irradiation with light diminishes magnetic field require for magnetic reversal in the medium, so that a magnetic head suitable for practical use and high-speed recording can be

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[1] Applicants' Claim 1, lines 14-20.
[2] E.g., Specification from page 5, line 35, to page 6, line 25.
[3] Specification at page 11, lines 22-25.
[4] Specification at

implemented."[5] Applicants submit that the cited documents do not, individually or in combination, teach or disclose Applicants' Claim 1.

Chen discloses a read/write head (see Figure 4) that includes an optical waveguide core 88 (see Figures 3A and 4) for guiding light to a medium 14. Ueyanagi discloses a recording/reproducing head 1 (see Figure 1A) that includes a transparent condensing medium 6 that propagates a light beam to a magneto-optic recording film 8b. Stovall discloses a head gimbal assembly (see Figure 5) that includes a waveguide 88 for guiding light to a medium.

As acknowledged in the Office Action, none of these documents disclose "specifics with respect to the size of any aperture and light-absorbing layer."[6] Additionally, Applicants note that none of these documents teach or suggest the use of an aperture at all, in contrast to Applicants' Claim 1.

In order to remedy the deficiencies of Chen, Ueyanagi, and Stovall, the Office Action relies on the teachings of Kobayashi, Peale, and Majors. However, as discussed below, any suggested combinations of these documents are non-obvious and, in any case, fail to teach or suggest Applicants' Claim 1.

Kobayashi discloses a masked semiconductor laser 10 (see Figure 1) that includes a masking layer 4 with a light-emitting hole K. However, it would not have been obvious to one of ordinary skill in the art at the time of the invention to combine the teachings of Kobayashi with any of Chen, Ueyanagi, and Stovall, as none of these references even suggests the inclusion of a masking layer with a light-emitting hole. Also, Kobayashi itself does not provide any suggestion to incorporate its masking layer and light-emitting hole into a recording head system, such as one of systems of Chen, Ueyanagi, and Stovall.

[5] E.g., Specification at page 12, lines 10-18; and at page 24, lines 25-35.
[6] Office Action, second paragraph of Section 7.

Both Chen and Stovall teach the use of a tapering waveguide to funnel a relatively large laser beam to a smaller beam at an exit end.[7] The systems of Chen and Stovall rely on the varying dimensions of a light-guiding material to create a desirably small light spot. As such, there would have been no motivation for an ordinary artisan familiar with either system to look to the masking layer and light-emitting hole of Kobayashi to create a smaller light spot. This is especially apparent given the similar dimensions achieved at an exit end for emitting light: e.g., between 0.1 and 1.0 micron in width in Stovall, and under or around 1.0 micron for either width or height in Kobayashi.[8] That is, to an ordinary artisan, it would have been unnecessary to incorporate the teachings of Kobayashi into either Chen or Stovall to create a small light spot.

Moreover, in Ueyanagi, a laser beam is condensed by an optical system such that a beam spot 9a on a condense surface 6c is desirably small (e.g., approximately 0.2 micron). The system of Ueyanagi uses an optical system consisting of a mirror and condense lenses to achieve a light spot of a size comparable to that achieved using the system of Kobayashi. As such, there would have been no motivation for one of ordinary skill in the art at the time of the invention to combine the teachings of Ueyanagi and Kobayashi to create a small light spot.

Further, the concept of Kobayashi relies on the blocking or cutting off of light,[9] whereas the systems of Chen, Ueyanagi, and Stovall all utilize entire beams of light without masking. To this end, the systems of Chen, Ueyanagi, and Stovall actually teach away from Kobayashi.

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[7] Chen at Figure 6 and col. 5, lines 49-60; and Stovall at Figure 5 and col. 6, lines 2-5, "...a thickness ranging between 0.1 and 1.0 microns at the laser beam exit end..."
[8] e.g., Kobayashi at col. 3, line 64; col. 4, and lines 46-47.
[9] e.g., Kobayashi at Abstract.

For at least the above reasons, it would not have been obvious to one of ordinary skill in the art at the time of Applicants' invention to combine the teachings of any of Chen, Ueyanagi, and Stovall with the teachings of Kobayashi.

However, even if it were somehow possible to combine the teachings of any of Chen, Ueyanagi, and Stovall with the teachings of Kobayashi, any resulting combinations would not teach or suggest Applicants' Claim 1. That is, none of these four references teach or suggest, individually or in combination, the features of an "aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction along a longitudinal extension of recording tracks formed on the recording medium, and a width W1 of the aperture taken along the polarizing direction being smaller than a width W2 of the aperture taken approximately perpendicular to the polarizing direction," as recited by Applicants' Claim 1. This deficiency is acknowledged in the Office Action: "With respect to the direction of polarization and which aperture dimension is larger than the other, no such direction of polarization reference is given."[10] To further remedy the deficiencies of Chen, Ueyanagi, Stovall, and Kobayashi with respect to the above features, the Office Action looks to the combination of Peale and Majors.

In the above-discussion, Applicants have discussed why any combination of the teachings of Chen, Ueyanagi, and Stovall with the teachings of Kobayashi would be both non-obvious and deficient with respect to Applicants' Claim 1. Therefore, Applicants have already sufficiently addressed the rejection of Claim 1 under 35 U.S.C. §103(a). However, for the sake of completeness, the further inclusion of the teachings of Peale and Majors will be discussed.

[10] Office Action, fourth paragraph of Section 7.

Peale discloses an optical detection apparatus including a laser (see Figure 1) that is able to operate in one of two states.[11] Majors discloses a laser diode (see Figure 4) arranged such that the laser operates in a TE polarization mode.[12] However, it is unclear from the Office Action how any possible combination of Peale and Majors would remedy the deficiencies of Chen, Ueyanagi, Stovall, and Kobayashi with respect to Applicants' Claim 1. Neither Peale nor Majors teaches or suggests an "aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction along a longitudinal extension of recording tracks formed on the recording medium, and a width W1 of the aperture taken along the polarizing direction being smaller than a width W2 of the aperture taken approximately perpendicular to the polarizing direction," as recited by Applicants' Claim 1. These particular features are not suggested by Peale or Majors simply because they provide for lasers which can operate in different modes of polarization. For example, neither Peale nor Majors suggest the use of an aperture as recited in Applicants' Claim 1. As such, any combination of Peale and Majors fails to remedy the deficiencies of Chen, Ueyanagi, Stovall, and Kobayashi with respect to Applicants' Claim 1.

Therefore, Applicants' Claim 1 is patentable over Chen, Ueyanagi, Stovall, Kobayashi, Peale, and Majors, taken individually or in any of the suggested combinations. Accordingly, Applicants request reconsideration and withdrawal of the rejection of Claim 1 under 35 U.S.C. §103(a). Claims 2-8 depend from Claim 1 and are patentable for at least the reasons discussed above.

Claim 10 recites, among other features:

> ...the aperture being adapted so that a polarizing direction of the light emitted from the laser device is approximately perpendicular to a direction

[11] Peale at Figures 7 and 8, and at col. 5, lines 9-20.
[12] Major at col. 6, lines 50-58.

along a longitudinal extension of recording tracks formed on the recording medium, and

a width of the aperture taken along the polarizing direction being smaller than a width of the aperture taken approximately perpendicular to the polarizing direction.[13]

These features are similar to features of Claim 1 to the extent that the rejection of Claim 10 under 35 U.S.C. §103(a) can be addressed by arguments substantially similar to those presented above with respect to the rejection of Claim 1. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of Claim 10 under 35 U.S.C. §103(a). Claim 11 depends on Claim 10 and is patentable for at least the reasons discussed above.

Referring to Figures 1A and 1B, an aspect of the present invention provides for laser device 10 to be recessed from a tip of recording pole 40 when viewed from a recording medium (e.g., Figure 1A, where an unseen portion of laser source 10 overlaps tip 40). In this configuration, tip 40 protrudes between a portion of laser device 10 and recording medium 20 and 21. Due to the close proximity of aperture 36 (Figure 2A) and tip 40 resulting from this configuration, heating and magnetic recording on recording medium 20 and 21 can be performed with optimum timing.[14]

These feature are broadly encompassed by Claim 12, which recites, among other features, "a radiating portion emitting the heat beam of the heating source being in a receding position from a tip of the magnetic pole when seen from the recording medium, and the tip of the magnetic pole protruding between the heating source and the recording medium."[15] Applicants respectfully submit that none of Chen, Ueyanagi, and Stovall anticipates or suggests these features.

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[13] Claim 10 at lines 19-25.
[14] Specification at page 17, lines 18-29.
[15] Claim 12, lines 7-11.

In Chen, a write element 60 is disposed adjacently to waveguide core 88;[16] however, Chen does not disclose a radiating portion being in receding position from a tip of a magnetic pole when seen from a recording medium, nor that the tip protrudes between a heating source and the recording medium, as recited in Applicants' Claim 12. Rather, in Chen, write element 60 and waveguide core 88 are arranged to a parallel such that a second pole layer 96 does not protrude between a heating source and recording medium 14. Stovall, referring to Figure 5, suffers from the same deficiencies of Chen with respect to Applicants' Claim 12.

In Ueyanagi, a magnetic coil 10 is positioned adjacently to condensing medium 6;[17] however, Ueyanagi does not disclose a radiating portion being in receding position from a tip of a magnetic pole when seen from a recording medium, nor that the tip protrudes between a heating source and the recording medium, as recited in Applicants' Claim 12. Specifically, in Ueyanagi, magnetic coil 10 is not arranged to protrude between laser 2 and disk 8.

For at least these reasons, Applicants' Claim 12 is patentable over Chen, Ueyanagi, or Stovall. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of Claim 12 under 35 U.S.C. §102(e). Claims 13-15 depend from Claim 12 and are patentable at least for the reasons discussed above.

Claim 16 recites, among other features, the feature of a radiating portion as identically recited in Claim 12. Accordingly, Claim 16 is also patentable over Chen, Ueyanagi, or Stovall for at least the reasons discussed above. Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection of Claim 16 under 35 U.S.C. §102(e).

[16] Chen at Figures 4 and 5.
[17] Ueyanagi at Figures 1A.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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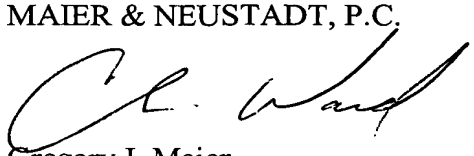

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